DOCUMENT RESUME

ED 273 465 SE 046 925

AUTHOR Guthrie, Larry F.
TITLE Increasing Opportunities for Scientificy Literacy: A Self-Evaluation Packet. Opportunity Systems in Science and Technology Study Series, Volume III.
INSTITUTION Far West Lab. for Educational Research and Development, San Francisco, Calif.
SPONS AGENCY National Inst. of Education (ED), Washington, DC.
PUB DATE 31 Aug 85
CONTRACT 400-83-0003
NOTE 12p.; For volumes I and II, see SE 046 923-924.
PUB TYPE Guides - Non-Classroom Use (055)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Curriculum Evaluation; Educational Assessment; High Schools; *Inservice Teacher Education; Models; *Program Evaluation; Program Improvement; Science Education; *Science Instruction; *Scientific Literacy; *Secondary School Science

ABSTRACT

Designed to assist teachers in the improvement of science instruction at the secondary level, this third of a three part series of guidebooks of the Opportunity Systems in Science and Technology Study Series provides information and exercises on evaluating science programs and teaching. Initially a review is presented of the components of scientific literacy and the findings of the Opportunity Systems in high school science study are summarized. The following sections consist of a form for organizing information on particular aspects of the science program and also a series of points to consider in relation to the questions posed. Topics addressed in the sections include: (1) science curriculum structure (offering suggestions for constructing a science course chain and program alternatives); (2) exercises of opportunity (highlighting enrollment aspects); and (3) emphasis on scientific literacy in instruction (examining the factors of time and focus already given to components of scientific literacy). (ML)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED273465

INCREASING OPPORTUNITIES FOR SCIENTIFIC LITERACY:

A SELF EVALUATION PACKET

Opportunity Systems in Science and Technology Study Series

Volume III

Larry F. Guthrie

August 31, 1985

Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

SE 046 925

The author wishes to acknowledge the support of the National Institute of Education, Department of Education, under NIE Contract 400-83-0003 to the Far West Laboratory for Educational Research and Development, San Francisco, California. The opinions expressed herein do not necessarily reflect the position or policy of the Institute and no official endorsement by the National Institute of Education should be inferred.

PREFACE

This guidebook is the third of a series of teacher inservice materials produced by the Secondary Science and Mathematics Improvement (SSAMI) Program at the Far West Laboratory for Educational Research and Development. The goal of the SSAMI Program is to study and improve instruction in science and mathematics at the secondary level. During the 1983-1984 school year, one of the ongoing projects of SSAMI was the Opportunity Systems in Science and Technology Study. This guidebook, along with two previous booklets, represents an effort to translate the background and findings of that study into a set of materials that provides teachers not only with new knowledge about the goals of science instruction and its current practice, but also with practical recommendations for moving current practice closer to these goals.

We wish to thank Dr. John Taylor, Teaching and Learning Division, National Institute of Education, for his support in this and other work. His interest in exploring innovative ways of approaching the problems that confront educators is appreciated.

Larry F. Guthrie
Project Director, Opportunity Systems in Science and Technology Study

John R. Mergendoller
Principal Investigator, Secondary Science and Mathematics Improvement Program

TABLE OF CONTENTS

INTRODUCTION 1

Scientific Literacy 1
Findings of the Study 2

SCIENCE CURRICULUM STRUCTURE 3

Science Curriculum Structure: Points to Consider. . . . 4

EXERCISE OF OPPORTUNITY. 5

Exercise of Opportunity: Points to Consider 6

EMPHASIS ON SCIENTIFIC LITERACY IN INSTRUCTION 7

Emphasis on Scientific Literacy in Instruction: Points to Consider. 8

INTRODUCTION

This booklet is third in a series of training packets designed for high school science departments and teachers. It is intended to provide you with information and exercises with which you can evaluate your science program and teaching.

The packet is divided into four sections. In the Introduction, we briefly review what scientific literacy is and summarize the findings of the study, Opportunity Systems in High School Science. More complete information on these topics is the focus of Packets I and II. The next three sections are designed to guide you in a self-evaluation of the opportunities for scientific literacy in your school and classroom. The focus of these sections is on a) the science curriculum structure, b) the exercise of opportunity, and c) the emphasis on scientific literacy in instruction. In each section, you are first asked to provide information on particular aspects of your individual science program; then you are given several points to consider in relation to your responses.

SCIENTIFIC LITERACY

The focus of the packet is on improving the opportunities of ALL students to become scientifically literate. As described in the other volumes of this series, however, "scientific literacy" doesn't always mean the same thing to all people. Using the common elements of popular definitions, we have developed a framework of scientific literacy consisting of five components:

Basic facts and concepts of science

Science as a social historical process

Science as a reasoning process

Science, technology and society

Personal use of science

Complete definitions and examples of each of these are given in Volume I. In that booklet, we also explain the way in which the four "relating" components represent <u>contexts</u> for presenting and learning the content of science.

FINDINGS OF THE STUDY

In the second volume of this series, the findings from an indepth study of the opportunities for scientific literacy in six high schools were presented and discussed as part of a framework for analyzing opportunities for scientific literacy.

- The science curriculum structure establishes the basic opportunities students have available. It includes the course offerings available to students and the policies and practices that control their entry and movement through courses. We found course sequences and enrollment control mechanisms to be quite different across the six schools. Entry options also varied among the schools.

- Entry options, and the science curriculum structure as a whole, affected science enrollments by grade and by level.

- High school teachers give priority to facts, science process and attitudes; the other components of scientific literacy are given little attention. Even though many could give well-articulated definitions of scientific literacy, their emphasis was on a limited set of components.

- The nature of laboratory activities and teaching in college-prep classes tend to provide students with somewhat greater opportunties for scientific literacy. Instructors in college-prep courses practiced more of those instructional processes associated with effective teaching. They seemed better prepared, more efficient in classroom management, and used time well.

SCIENCE CURRICULUM STRUCTURE

1. Construct a science course chain. Based upon the science offerings at your school, draw a science course chain like those presented in Packet #2. Space for your chain is provided after the example chain shown below. Begin with entry-level courses and add branches for the sequence of courses students usually take. Categorize each course as general, mixed, or college-prep and label it with G, M, or C. Rules for classifying courses are given in Volume II, p. 2.

Example Course Tree

Draw your course chain here.

2. How many courses are classified as:

college-prep _____ mixed _____

general _____

3. How many of the mixed or general courses are second-year courses (require one year of science)? _____

4. How many entry options do students have? _____

5. Do students begin science in 9th or 10th grade? _____

6. How is it decided which course a student takes? _____

_____

7. How many science courses do students need to graduate? _____

SCIENCE CURRICULUM STRUCTURE: POINTS TO CONSIDER

- Look at your course chain. The chain gives you a visual representation of the alternatives available to students with different interests and abilities. If the college-prep courses far outnumber alternatives, your curriculum may be limiting the opportunities of those students not bound for college.
- Your responses to questions 2 and 3 are a further indication of the relative emphasis in the curriculum on college-prep and non-college options. All students should have options available beyond the entry course.
- Entry options are also important. While student ability is important, findings from our study (and others) suggest that entry level mixed courses provide more opportunity for all students without holding back the most talented. Early placement of students into "dead-end" courses can mean that they are forever cut off from more advanced courses. All students should have a chance to take more than one or two science courses. In addition, requiring most students to wait until 10th grade to begin science is a simple way of reducing their science opportunity by one year.

EXERCISE OF OPPORTUNITY

1. Collect science enrollment figures for your school. (This may be an exercise you want to do as a department.) In the space provided below, calculate enrollment figures by grade and by level (college-prep, mixed, general, remedial). (See Tables 1 and 2 in Volume II.) Calculate percentages of total school enrollment.

Science Enrollment by Grade

Grade

	9	10	11	12	Total
Enrollment					
Percent School Enrollment					100%

Science Enrollment by Level

Level

	General	Mixed	College-Prep	Total
Enrollment				
Percent School Enrollment				100%

EXERCISE OF OPPORTUNITY: POINTS TO CONSIDER

- Compare the grade enrollments at your school with those on Table 1. First look at the total. An overall enrollment of 60% was about average for the schools we studied. If your school's science enrollment is quite a bit less, you should reconsider the organization of the curriculum. Go back to the section on Science Curriculum Structure and look for ways to increase enrollment.

  Overall, the enrollments in the schools we studied showed a drop-off in grades 11 and 12. What is the situation in your school?

- Next consider the enrollments by level (Table 2). Does your program seem to enable a relatively high percentage of students to enroll in second-year courses? advanced college-prep courses? Compare the enrollments with those of the six schools in the study. All students should have an opportunity to take advanced courses. Applied courses which "duplicate" the content of college-prep courses will tend to draw off enrollment from the college-prep curriculum.

EMPHASIS ON SCIENTIFIC LITERACY IN INSTRUCTION

As described in Volume I of this series, teachers can emphasize the components of scientific literacy without taking away from the content of their regular curriculum. The first step in seeing how to do this is to examine how much emphasis you already give to those components. Circle the appropriate numbers below.

1. How much emphasis do you give to the following components of scientific literacy?

	NONE	SOME	A LOT
basic facts and concepts	1	2	3
science as a social, historical process	1	2	3
science for personal use	1	2	3
science as a reasoning process	1	2	3
science, technology and society	1	2	3

2. In the last topic you taught, approximately how much time did you spend on the following?

	NONE	LESS THAN 10%	10-50%	OVER 50%
basic facts and concepts	1	2	3	4
science as a social, historical process	1	2	3	4
science for personal use	1	2	3	4
science as a reasoning process	1	2	3	4
science, technology and society	1	2	3	4

EMPHASIS ON SCIENTIFIC LITERACY IN INSTRUCTION: POINTS TO CONSIDER

- Look at the ratings you gave in question 1. Which of the components do you emphasize most? Do these agree with the ones emphasized by the teachers in the study (facts and concepts, science as a reasoning process)? Consider your reasons for not emphasizing the others.

- Examine your responses to question 2. Does your allocation of time agree with your overall emphasis? Think of ways you might be able to increase the time allocated to components of scientific literacy such as science for personal use or science, technology and society.

- Read pages 6-7 of Volume I and think about how you could modify the way you taught the last topic in order to give more attention to scientific literacy.

Which components of scientific literacy will you emphasize? For most topics, there should be no more than two components which serve as the organizing theme for the topic content.